facing microscopists examining animal tissues is that the cells of different tissues appear quite different. Moreover, these cells lack a cell wall, still treated by most investigators as the defining characteristic of plant cells. Schleiden's associate Schwann, however, focused on the similarities between the constituent units of different animal tissues and plant cells.[8] The most important similarity was the nucleus, which Schleiden had shown him in plant cells. Finding opaque spots in the units of different animal tissues, especially those in an embryological state, Schwann identified them as nuclei. Because all animal tissue he examined contained nuclei, at least early in development, Schwann concluded that all animal tissues were comprised of cells despite their varied appearance. Figure 3.2 presents Schwann's drawings of several different cell types with their nuclei.

At the heart of both Schleiden's and Schwann's characterization of cells was an account of their formation. Schleiden (1838) had proposed that cells formed within preexisting cells through a physical process of accretion, first of the material comprising the nucleus around the nucleolus, and then another layer, corresponding to the cytoplasm, around the nucleus.[9] Schwann (1839/1947) adopted this mechanism for animal cells, but situated the process not in existing cells but in the intercellular fluids. As a result, Schwann referred to the process in animals as *exogenous cell formation* and that in plants as *endogenous cell formation*. This account of cell development provided the foundation to the cell doctrine: "The elementary parts of all tissues are formed of cells in an analogous, though very diversified manner, so that it may be asserted *that there is one universal principle of development for the elementary parts of organisms, however different, and that this principle is the formation of cells*" (p. 165).

Given that other investigators were already describing cell division, and that Schleiden and Schwann were masters of microscopic technique, a question arises as to why they were convinced that cells formed in such a manner. Here it is important to appreciate that a central objective for Schwann in developing his cell theory was to provide a mechanistic account of the basic structures of living organisms. (Schwann was a member of the group of investigators working with Johannes Müller who pursued such a mechanistic vision

[8] Schwann was working in the laboratory of Johannes Müller, who had himself observed cells in the *chorda dorsalis* and noted the similarity between them and plants (Müller, 1835) and had drawn Schwann's attention to the similarities.

[9] One attractive feature for Schleiden of his account of cell formation was that it provided a role in development for the nucleus. Noting its regular appearance in embryos, Schleiden had made accounting for its role in development a major objective.